

### Claims

1. An integrated photoelastic modulator and diagnostic system comprising:

5 a photoelastic modulator including an optical element having a primary aperture through which primary light may be directed; and

a diagnostic system including a diagnostic light source for directing through the optical element diagnostic light that is distinct from the primary light.

10 2. The system of claim 1 wherein the diagnostic light source is configured so that the diagnostic light is directed through the optical element at a location remote from the primary aperture.

15 3. The system of claim 1 wherein the photoelastic modulator is operable to provide retardance characteristics in primary light that is directed through the optical element, and wherein the diagnostic system includes processing means for determining at least one retardance characteristic provided by the photoelastic modulator.

4. The system of claim 3 including display means for displaying the retardance characteristic determined by the processing means.

20 5. The system of claim 3 including feedback means for converting signals representing the determined retardance characteristic into control signals for the photoelastic modulator.

25 6. The system of claim 2 wherein the photoelastic modulator is operable to provide retardance characteristics in primary light that is directed through the optical element, and wherein the diagnostic system includes processing means for determining a retardance characteristic of the diagnostic light and correlating that retardance characteristic to a retardance characteristic in the primary light that is provided by the photoelastic modulator.

7. A method of operating a photoelastic modulator that is operable for vibrating an optical element to impart retardance characteristics in a primary light beam that is directed through the optical element, comprising the steps of:

directing a diagnostic beam of light through the optical element;

5 determining a retardance characteristic of the diagnostic beam of light that passes through the optical element; and

generating a diagnostic signal representative of that retardance characteristic.

10 8. The method of claim 7 further comprising the step of converting the diagnostic signal to a verification signal that is representative of a retardance characteristic of the primary light beam.

9. The method of claim 7 including the step of converting the diagnostic signal into a control signal for controlling the photoelastic modulator.

15 10. The method of claim 7 including the step of transmitting the primary light beam and the diagnostic beam of light through the optical element so that the beams do not interfere with each other.

20 11. The method of claim 10 wherein the directing step includes the step of directing the diagnostic beam of light through a portion of the optical element that is spaced an offset distance from another portion of the optical element, through which other portion the primary light beam is directed.

12. The method of claim 11 including the steps of considering the offset distance and the diagnostic signal for determining a verification signal that is representative of a retardance characteristic of the primary light beam.

25 13. The method of claim 10 including the step of housing the optical element in a manner that defines two discrete apertures through which the primary and diagnostic light beams may be directed.

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14. A diagnostic system for a photoelastic modulator that is operable for vibrating an optical element to impart retardance characteristics in primary light that is transmitted through the optical element, comprising:

5 a source of diagnostic light arranged to transmit diagnostic light through the optical element; and

a detector for detecting at least a portion of the diagnostic light transmitted through the optical element without detecting primary light that is transmitted through the optical element.

10 15. The system of claim 14 including mounting means for mounting the diagnostic system in a manner that permits simultaneous transmission of the diagnostic light and the primary light through the optical element.

16. The system of claim 14 further comprising a housing for enclosing the optical element but for two discrete openings.

15 17. The system of claim 14 wherein the light source includes a collimating lens and polarizer.

18. The system of claim 14 wherein the detector includes a waveplate and an analyzer.

20 19. The system of claim 1 wherein the diagnostic light source provides diagnostic light that has a wavelength other than the wavelength of the primary light.

20. The method of claim 14 wherein the directing step includes the step of selecting a wavelength of the diagnostic beam to be different from the wavelength of the primary beam.

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